N O R T H D A K O T A 1 7 M c H E N R Y

FIELD APPRAISAL ANALYSIS

Prepared by
Economic Analysis Section
Electric Operations and Loans Division
RURAL ELECTRIFICATION ADMINISTRATION

Field Appraisal
Completed in
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October 26, 1953

Economic Analysis Section
Electric Operations and Loans Division

SUMMARY AND CONCLUSION
NORTH DAKOTA 17 McHENRY

AREA CHARACTERISTICS

The population of the area decreased less than 1 percent between 1940 and 1950. Over the same period, rural-farm population decreased 22 percent. The major source of agricultural income in 1949 was from crops (72 percent), mostly wheat, flax, and other small grains. The average value of land and buildings was $15,600, which is 75 percent greater than in 1945. Nearly 8 percent of the farmers worked 100 or more days off the farm. The topography is undulating to rolling, interspersed with broken lands in some sections. The soils are dark brown, productive, well-drained silt loams and loams.

ULTIMATE NUMBER OF CONSUMERS

On June 30, 1953, this cooperative was serving a total of 4,139 consumers. The manager has estimated that a total of 5,130 consumers may be served ultimately. From a careful consideration of related facts pertaining to the area, it is believed that an estimate of 4,900 consumers would be more realistic and in line with the findings of the survey.

ESTIMATED FUTURE CONSUMPTION OF ELECTRICITY

This system was energized in 1940. Since then, average monthly farm consumption rose from 64 kwh in 1941 to 259 in 1952. This is an increase of almost 18 kwh in average monthly usage each year. Farm consumers indicated that they expected to increase their use of electricity 32 percent by 1956. Nonfarm and town residential consumers indicated an increase of 22 percent during the same period.

Increasing cost of purchased power and firmly established use of LP gas are serious deterrents to future use of electricity in this area. The survey revealed that more than one-third of the consumers in the area expect to continue to use LP gas for one or more purposes.

Based on all factors believed to be significant, this analysis leads to the following estimates, which are certified as being reasonable and may be expected to be attained in the years indicated:

Class of Consumer	12 Months Ended April 30, 1953	1955	1958	1963
Farm	268	310	360	450
Nonfarm Residential	180	210	240	275
Town Residential	142	160	190	230
Public Buildings	25[a]	30	35	40
Small Commercial	350[a]	425	465	525
Other (annual) (3 consumers including Street Lights & CAA Beacons, each)		29,800	29,900	30,000

Class of Consumer (cont'd)	KW Demand	1955	1958	1963
Large Commercial (annual)				
Alymer Pumping Station	17	15,000	15,000	15,000
Benders Gravel Pit	5	1,000	1,000	1,000
Blackstead Grain Elevator	10	1,600	1,600	1,600
Farmers' Union Central Exchange (Butane Gas)	5	1,500	1,500	1,500
Farmers' Union Oil Company	5	1,600	1,600	1,600
Foxholm Elevator #1	8	4,000	4,000	4,000
Foxholm Elevator #2	8	1,500	1,500	1,500
GNRR Pumphouse (2 meters @)	10	5,000	5,000	5,000
Miller's Strip Mine	55	50,000	55,000	50,000
N. Central Experiment Station	8	8,000	8,500	9,000
Dept. of Audits & Accts. (Police Radio)	5	13,000	13,000	13,000
Quality Lignite Mine	125	60,000	60,000	60,000
Triangle Theater (Outdoor)	20	24,000	24,000	24,000
Herman Vix Mine (Coal)	15	12,000	12,000	12,000
786th A.C.W. Squadron (Radar Sta.)	250	655,000	655,000	655,000
Big Sky Ranch (Alfalfa Processing Plant)(800 kw demand in 1955--1,000 kw demand in 1958 & 1963)		3,200,000	4,000,000	4,000,000

a/ Estimated.

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October 26, 1953

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ANALYSIS OF BASIC FACTORS RELATED TO THE RURAL ELECTRIFICATION LOAN FOR NORTH DAKOTA 17 McHENRY

This analysis of basic factors related to the future consumption of electricity by consumers of the Verendrye Electric Cooperative, Incorporated, with headquarters at Velva, North Dakota (Figure 1), is based on a field study conducted by Arthur S. Hiatt, Agricultural Economist, Economic Analysis Section, Electric Operations and Loans Division, and was completed in July 1953. This analysis was prepared by Mr. Hiatt.

The field work consisted primarily of visits to 177 served and potential consumer units. Of these, 123 were served farm consumers, 31 were served nonfarm and town residential consumers, 9 were served public buildings, 2 were served small commercial consumers, 11 were unserved farm units, and 1 was an unserved school. In addition, 8 farms served by other power suppliers, 6 vacant farms, 12 abandoned farms, and 12 idle services were noted in the sampled area by the appraiser.1/ Local bankers and agricultural leaders were consulted regarding local economic trends and their estimates of the future for the area with respect to the use of electric power. Supporting economic data were obtained from the U. S. Census for McHenry, Sheridan, and Ward Counties, and from other secondary sources.

ULTIMATE NUMBER OF CONSUMERS

On June 30, 1953, the cooperative was serving 4,139 consumers, of which 3,585 were farm users, 227 were nonfarm and town residential consumers, 311 were small commercial consumers, and 16 were large commercial consumers. The manager has estimated that a total of 5,130 may be served ultimately (Figure 2). This is an increase of about 24 percent over those presently receiving service. The ultimate number, according to the manager, includes 3,800 farm consumers, which exceeds the number in this class now being served by 215, or an increase of about 6 percent. Also included in the manager's estimate are 800 town residential consumers which is 588 more than they are now serving, 450 small commercial consumers which is 139 more than are now being served, 50 large commercial and 30 nonfarm residential consumers which exceed the numbers in these classes now being served by 35 and 15, respectively.

1/ Farm respondents in the survey were randomly selected and comprise an area sample of approximately 3 percent of the consumer units within the system's optimum boundary. For the Sand Hills section, an area sample of about 9 percent was employed to assure an adequate number of respondents from this area. Nonfarm and town residential consumer respondents were randomly selected from the system's billing records and comprise approximately 14 percent of the nonfarm and town residential consumers presently served.

The number of various units as disclosed by an expansion of the sample data are compared with the manager's estimate in Table I. The manager's estimate of the ultimate number of farm consumers may appear to be too high, but it may very well be achieved provided the farms not now wanting electric service should change their position and request service in the future. The manager's estimate of an increase of 15 in the nonfarm residential consumers seems to be reasonable.

In the town residential consumer class, the manager based his estimate of an increase of 588 primarily upon the expected growth in the area the system serves adjacent to the city of Minot. At present they are serving 212 in this class, most of whom resid in East Minot. The development of this particular area has not been co-ordinated but has "mushroomed-up" in recent years. Individual homes must provide for their own water and sewage disposal. Streets have been laid out but are not well kept. Few of the homes appeared to be desirable, and the turnover in occupants has been high. It is believed that an increase of about 250 in this class is more realistic.

The manager's letter and the system's operating reports list 311 small commercial consumers now being served and report none in the public buildings class. The appraiser was informed by the cooperative personnel that 222 of these were actually schools, churches, or community halls, leaving a balance of 89 as small commercial consumers. Therefore, the manager's estimate that 450 consumers in this class will be served ultimately includes 222 public buildings, leaving 228 actual small commercials. This is an increase of 139 small commercial consumers, which in the opinion of the appraiser is considerably higher than the facts support. It is believed that an estimate of an increase of 20 in public buildings and of 70 in small commercial consumers is reasonable.

Although the manager's estimate of an increase of 34 large commercial consumers is not supported by factual data, it could be achieved. However, the billing records of some of the consumers classed as large commercial suggest they should be reclassified as small commercial.

TABLE I

DISTRIBUTION OF CONSUMER UNITS WITH RESPECT TO ELECTRIC SERVICE

Class (1)	Number In Sample (Exclusive of Sand Hills Area) (2)	Number In Sample (Sand Hills Area) (3)	Expanded Number[a] (4)	Manager's Estimate (5)	Estimated Number (6)
Served					
Farm	98	25	3,545	3,585	3,585
Nonfarm	—	—	—	15	15
Town Residential	—	—	—	212	212
Schools and Churches	7	2	255	—[b]	222
Small Commercial	2	—	67	311[c]	89
Large Commercial	—	—	—	16	16
Potential					
Farm[d]	8	3	300	215	215
Nonfarm Residential	—	—	—	15	15
Town Residential	—	—	—	588	250
Schools and Churches	1	—	33	—[b]	20
Small Commercial	—	—	—	139	70
Large Commercial	—	—	—	34	—
Other					
Idle Services	7	5	289	—[e]	191
Vacant	5	1	178	—	—
Abandoned	7	5	289	—	—
Served by Other Power	4	4	177	—	—
Total Units	139	45	5,133	5,130	
Total Estimated Ultimate Consumers of Electricity					4,900

a/ Derived by expanding sample data. A 9 percent sample was used in the Sand Hills area and a 3 percent sample was used in the rest of the area.
b/ Not shown separately in manager's letter.
c/ Includes 222 served public buildings (schools, churches, community halls).
d/ Ten of the respondents in this class stated that they were not interested in electric service at this time.
e/ Not indicated in manager's letter or system's operating reports.

NATURE OF PRESENT AND INDICATED FUTURE CONSUMPTION OF ELECTRICITY AS REVEALED BY THE SURVEY

A tabulation of the raw data secured from the respondents revealed the following monthly consumption figures:

TABLE II

INDICATED MONTHLY KWH CONSUMPTION[a/]

Consumer Class	Present	Future[b/]	Percent Increase
Farm	300	396	32
Nonfarm and Town Residential	220	268	22

a/ Based on indications by respondents in the survey and average energy requirements as determined by REA on a countrywide basis. Farm consumers were using electricity at 99 percent of the average rate established by REA on a countrywide basis. Nonfarm and town residential consumers were using 92 percent of average.

b/ Based on what respondents expect to add in 3 years.

Historical consumption records for farm, nonfarm, and town residential consumers in the survey indicate a rising average consumption. Except for the current year's average, which is based only on five months' consumption, farm consumers added since 1949 appear to have attained lower initial averages than those connected during the earlier years of the system's existence (Table III). Over the same period, there appears to be no marked trend in initial averages attained by the nonfarm and town residential consumers (Table IV).

TABLE III

AVERAGE MONTHLY CONSUMPTION OF 119 FARM CONSUMERS

Total Number Years With Electricity	Number of Schedules	Average KWH Consumption Per Month													
		1940	'41	'42	'43	'44	'45	'46	'47	'48	'49	'50	'51	'52	'53 a/
14	2	25	30	34	39	90	59	94	72	95	127	127	241	299	259
12	2	---	---	202	314	335	380	445	532	607	712	736	799	812	887
10	6	---	---	---	---	337	450	535	604	649	672	653	586	577	684
9	4	---	---	---	---	---	241	237	313	460	538	535	604	541	662
7	8	---	---	---	---	---	---	---	184	208	236	291	315	346	376
6	8	---	---	---	---	---	---	---	---	210	294	318	330	368	374
5	13	---	---	---	---	---	---	---	---	---	172	199	238	308	381
4	34	---	---	---	---	---	---	---	---	---	---	179	223	254	310
3	24	---	---	---	---	---	---	---	---	---	---	---	159	221	256
2	11	---	---	---	---	---	---	---	---	---	---	---	---	155	193
1	7	---	---	---	---	---	---	---	---	---	---	---	---	---	268
Weighted Average		25	30	118	176	287	324	374	343	349	333	277	274	296	342

a/ 1953 averages are based on first five months of the current year.

TABLE IV

AVERAGE MONTHLY CONSUMPTION OF 30 NONFARM AND TOWN RESIDENTIAL CONSUMERS

Total Number Years With Electricity	Number of Schedules	Average KWH Consumption Per Month													
		1940	'41	'42	'43	'44	'45	'46	'47	'48	'49	'50	'51	'52	'53 a/
14	1	72	89	164	228	231	216	293	308	480	501	503	554	566	498
8	1	---	---	---	---	---	---	27	171	144	195	234	240	253	244
6	2	---	---	---	---	---	---	---	---	206	418	534	519	452	525
5	4	---	---	---	---	---	---	---	---	---	70	120	103	173	240
4	5	---	---	---	---	---	---	---	---	---	---	203	162	176	226
3	5	---	---	---	---	---	---	---	---	---	---	---	132	196	259
2	9	---	---	---	---	---	---	---	---	---	---	---	---	132	137
1	3	---	---	---	---	---	---	---	---	---	---	---	---	---	244
Weighted Average		72	89	164	228	231	216	160	240	259	226	254	206	202	238

a/ Averages are based on first five months of the current year.

A saturation of electrical appliances and equipment measured in terms of the percent of consumers presently having them and a corresponding percent anticipated in the future was compiled from field schedules of presently connected consumers. The difference in saturation, as revealed by the increase in percentage points, was converted to future kwh requirements per 100 consumers for each appliance and piece of equipment. This tabulation is shown in Table V.

ECONOMIC CHARACTERISTICS

The population of the area decreased less than 1 percent between 1940 and 1950. Rural-farm population decreased 22 percent. Nonfarm and urban population increased 21 percent. Since 1940, the number of farms in the area has decreased 15 percent, as compared to 11 percent for the State. Farms average about 625 acres in size which is about the same average size for the State of North Dakota. Nearly 80 percent of the farms were owned in full or in part by their operators.

In 1949, the major source of agricultural income (72 percent) was from crops--mostly wheat, flax, and other small grains. Dairy products accounted for a little more than 7 percent, poultry products for about 1½ percent, and other livestock (principally cattle and calves) accounted for slightly more than 19 percent.

In 1950, the value of land and buildings averaged about $15,600, or about 75 percent greater than in 1945. Gross income from sale of farm products averaged $6,275 for the area in 1949. Nearly 8 percent of the farmers worked off the farm 100 or more days in 1949.

The economy of the area is primarily agricultural. Little opportunity for off-farm employment exists. Though there has been some activity in connection with oil leases, no producing wells are in the area and no evidence of any being drilled in the near future was noted by the appraiser. A number of coal mines are being worked in the area and provide a considerable quanity of low-grade fuel--mostly lignite--for commercial and home consumption in the region. The speculation in oil leases and the exploration of the oil potentialities in the Williston Basin has been partly responsible for the one-third increase in the population of Minot between 1940 and 1950.

Marketing facilities appear to be adequate. Grain elevators are located at easily accessible places throughout the system area. Most of the cattle move to eastern markets through the stockyards at West Fargo, North Dakota. Dairy products for the most part are marketed and consumed within the region.

Railroads and highways traverse the area (Figure 1). County roads are gravelled and generally well maintained. The local roads usually follow section lines and are kept in fairly good condition but are subject to considerable storm damage following rains.

TABLE V

PRESENT AND INDICATED SATURATION OF ELECTRICAL APPLIANCES AND EQUIPMENT AND CORRESPONDING ESTIMATED INCREASE IN KWH USAGE FARM, NONFARM AND TOWN RESIDENTIAL CONSUMERS, COMBINED

APPLIANCE OR EQUIPMENT	FARM				NONFARM AND TOWN RESIDENTIAL			
	PERCENT OF CONSUMERS		INCREASE		PERCENT OF CONSUMERS		INCREASE	
	PRESENTLY USING	INDICATING FUTURE USE	PERCENTAGE POINTS	KWH USAGE PER 100 CONSUMERS	PRESENTLY USING	INDICATING FUTURE USE	PERCENTAGE POINTS	KWH USAGE PER 100 CONSUMERS
AIR COMPRESSOR	23	28	5	175	—	—	—	—
ANIMAL CLIPPER	1	1	—	—	—	—	—	—
BATTERY CHARGER	40	41	1	12	3	3	—	—
BLANKET	2	2	—	—	—	—	—	—
BROILER	1	1	—	—	6	6	—	—
BROODER (BATTERY)	1	1	—	—	—	—	—	—
BROODER (INFRARED)	1	1	—	—	—	—	—	—
BROODER (HOVER)	30	32	2	286	6	6	—	—
BROODER (PIG)	2	2	—	—	—	—	—	—
CHURN	6	6	—	—	—	—	—	—
CLOCK	66	67	1	18	74	74	—	—
CLOTHES DRIER	3	10	7	4,900	10	16	6	4,200
COAL STOKER	3	5	2	480	—	—	—	—
CREAM SEPARATOR	53	58	5	175	3	6	3	105
DISHWASHER	—	1	1	30	—	—	—	—
DRILL PRESS	45	50	5	60	13	13	—	—
ELEVATOR (GRAIN)	6	6	—	—	—	—	—	—
FAN (CENT. HOT AIR CIR.)	8	9	1	240	13	13	—	—
FAN (EXHAUST)	1	2	1	15	—	—	—	—
FAN (HOUSEHOLD)	26	27	1	15	22	22	—	—
FAN, VENT. (DAIRY BARN)	3	3	—	—	—	—	—	—
FAN, VENT. (LIVESTOCK BARN)	1	2	1	200	—	—	—	—
FEED GRINDER OR ROLLER	2	5	3	1,674	—	—	—	—
FENCE	2	2	—	—	—	—	—	—
FOOD MIXER	60	63	3	75	55	58	3	75
FORGE	1	1	—	—	—	—	—	—
FREEZER (HOME)	52	69	17	15,300	13	26	13	11,700
GARDEN WATERING	5	5	—	—	—	—	—	—
HEADBOLT HEATER	35	37	2	30	23	23	—	—
HEATING PAD	—	—	—	—	19	19	—	—
HOT PLATE	14	14	—	—	6	6	—	—
HOT WATER CIR. PUMP	2	2	—	—	—	—	—	—
HOUSE HEATING	21	21	—	—	—	—	—	—
IRON	96	97	1	100	100	100	—	—
IRONER	7	9	2	240	19	19	—	—
LATHE	2	—	2	—	3	3	—	—
LIGHTING: BEEF CATTLE BARN	6	6	—	—	—	—	—	—
BUNK HOUSE	2	2	—	—	—	—	—	—
CAVE OR SPRING HOUSE	2	2	—	—	—	—	—	—
DAIRY BARN	2	2	—	—	—	—	—	—

Appliance or Equipment	Farm: Percent of Consumers: Presently Using	Farm: Percent of Consumers: Indicating Future Use	Farm: Increase: Percentage Points	Farm: Increase: KWH Usage Per 100 Consumers	Nonfarm and Town Residential: Percent of Consumers: Presently Using	Nonfarm and Town Residential: Percent of Consumers: Indicating Future Use	Nonfarm and Town Residential: Increase: Percentage Points	Nonfarm and Town Residential: Increase: KWH Usage Per 100 Consumers
Garage	39	42	3	24	26	29	3	24
General Barn	85	89	4	96	6	6	—	—
Grain & Feed Strge. Bldg.	34	39	5	10	—	—	—	—
Hog Barn	6	6	—	—	—	—	—	—
House Lighting	100	100	—	—	100	100	—	—
Milk House	10	10	—	—	—	—	—	—
Other Buildings	18	20	2	24	—	3	3	36
Poultry Brooder House	16	17	1	5	—	—	—	—
Poultry Laying House	41	45	4	140	3	3	—	—
Shop	26	28	2	24	—	—	—	—
Yard	98	99	1	18	10	10	—	—
Livestock Watering	60	64	4	720	6	6	—	—
Milk Cooler	1	2	1	2,323	—	—	—	—
Milk Pasteurizer	1	2	1	120	3	3	—	—
Milking Machine	23	30	7	2,296	—	—	—	—
Oil Furnace	9	11	2	600	19	19	—	—
Percolator	21	21	—	—	20	23	3	180
Power Saw	13	13	—	—	10	10	—	—
Pres. Sys. (Less than 22')	18	20	2	360	29	35	6	1,080
Pres. Sys. (Greater than 22')	22	37	15	3,600	13	13	—	—
Radio	99	100	1	100	97	100	3	300
Range	54	65	11	13,200	45	52	7	8,400
Refrigerator	85	93	8	2,880	91	97	6	2,160
Refrigerator (Walk-in)	1	1	—	—	—	—	—	—
Roaster	2	2	—	—	6	6	—	—
Seed Cleaner	12	13	1	3	—	—	—	—
Sewing Machine	21	23	2	20	29	29	—	—
Soldering Iron	23	24	1	15	3	3	—	—
Space Heater (Portable)	15	15	—	—	10	10	—	—
Stock Tank Heater	4	6	2	300	—	—	—	—
Sump Pump	5	5	—	—	—	—	—	—
Television Receiver	4	15	11	3,960	6	16	10	3,600
Toaster	82	82	—	—	84	90	6	210
Tool Grinder	40	47	7	175	—	—	—	—
Vacuum Cleaner	64	66	2	40	48	48	—	—
Ventilator (Window)	—	1	1	50	—	—	—	—
Waffle Iron	45	46	1	25	71	71	—	—
Washing Machine	92	95	3	105	97	100	3	105
Water Heater with Bath	23	41	18	54,000	20	26	6	18,000
Water Heater without Bath (but planning to add bath)	2	—	—	—	—	3	3	7,200
Water Heater (Pour-in)	—	2	2	1,200	—	—	—	—
Water Heater (Pres. Type)	4	6	2	3,000	—	—	—	—
Water Pail	1	1	—	—	—	—	—	—
Water Warmer	3	3	—	—	10	10	—	—
Welder	3	3	—	—	—	—	—	—
Wood Saw	32	50	18	1,350	—	3	3	225
	—	—	—	—	3	3	—	—

PHYSICAL CHARACTERISTICS

Most of the system area is in the Northern Dakota Black Prairies of central North Dakota; a portion is in the Souris Sandy Lands, and a part is in the Northeastern Missouri Plateau. The elevation ranges from 1,500 to 2,000 feet.

The topography is undulating to rolling, interspersed with hilly to broken lands in some sections. Numerous sloughs, ordinarily dry, part of the years, are found in various parts of the system area. In the recent wet years, they have become veritable lakes.

The soils mostly are dark brown, productive, well-drained silt loams and loams. Soils in the Souris Sandy Lands (Sand Hills area) are dark brown sandy loams and sands with porous subsoils. The Souris River provides drainage for most of the area.

The average annual precipitation is 15½ inches, with 82 percent falling during the months of April through October. The length of the growing season averages 116 days. The average January temperature is 7° F., and the average for July is 68° F. Droughts and hailstorms occur rather frequently and present severe hazards to dry-land farming in this area. Excessive rainfall and damaging sleet storms which occur less frequently present less of a hazard than droughts and hailstorms.

ANALYSIS OF FUTURE KWH CONSUMPTION

Since the system was energized in 1940, average monthly farm consumption has increased from 50 kwh to 268 kwh for the 12 months' period ending April 1953. This is an increase of 16 kwh in average monthly usage for each year. Table III shows, however, that new consumers, except those added in 1953, are generally added at levels of consumption considerably lower than that of the initial consumption of earlier consumers.

If consumption is to increase at the rate indicated in Table II, we might expect an average monthly farm figure of 354 kwh (268 x 1.32). The average monthly nonfarm and town residential figure would be 177 kwh (145 x 1.22). To achieve these increases, the specific additional kwh resulting from indicated future saturation of appliances and equipment as shown in Table V must be attained.

Ninety percent of the indicated increase would need to occur in the household. Moreover, 73 percent of the indicated increase would need to occur as a result of the addition of water heaters, home freezers, and ranges (Table VI).

Consideration must be given to other factors in arriving at estimates of future electric consumption. Among these are (1) the extent to which LP gas use is likely to reduce the indicated future increases in electrical usage, (2) a consideration of the fact that area coverage is nearly achieved and little dilution caused by new consumers being added will be experienced in future years, (3) a selected study of the Sand Hills area, and (4) the extent to which other related economic trends are likely to have their impact upon the indicated future consumption.

TABLE VI

INDICATED AND ESTIMATED KWH USAGE
FARM CONSUMERS BY CHARACTER OF
LOAD PER 100 CONSUMERS[a]

Use	Indicated Future Saturation	KWH Usage Per 100 Consumers: Indicated Increase	Percent of Indicated Increase	Estimated Increase	Present Use	Estimated Future Total
Major Household Uses						
Water Heater, Pres. Type	43	48,090	48.1	24,045	64,294	88,339
Home Freezer	69	13,329	13.3	10,663	43,124	53,787
Range	65	11,500	11.5	5,750	56,454	62,204
Clothes Drier	10	4,269	4.3	2,134	1,830	3,964
Television Receiver	15	3,450	3.5	3,105	1,255	4,360
Pres.Sys.(Greater than 22')	37	3,136	3.1	1,725	2,823	4,548
Refrigerator	93	2,509	2.5	2,384	26,972	29,356
Major Productive Uses						
Water Heater (Pour-in)	6	2,614	2.6	2,353	5,227	7,585
Milk Cooler	2	2,024	2.0	1,822	2,024	3,846
Milking Machine	30	2,000	2.0	1,800	6,572	8,372
Feed Grinder	5	1,458	1.4	1,312	972	2,284
Welder	50	1,176	1.2	1,058	2,091	3,149
Livestock Watering	64	627	.6	564	9,409	9,973
All Other Uses	—	3,838	3.9	3,454	91,168	94,622
Total		100,020	100.0	62,169	314,215	376,384
Estimated annual average increase (total) in kwh consumption per 100 consumers - 1956				62,169	314,215	376,384
Estimated annual average increase (total) in kwh consumption per consumer - 1956				622	3,142	3,764
Estimated monthly average increase (total) over a 3-year period - 1953-1956				52	262	314

a/ Adjusted to take into account that appliance usage and amount of electricity required is 99 percent of average for the United States as determined by REA; also, that average consumption of all farm consumers in 1952 was 88 percent of farm respondents in the sample.

Table VII indicates that 37 percent of the farm consumers are presently using LP gas for one or more purposes. The remaining 63 percent of the farm consumers have indicated no intention of using gas. In contrast, about one-half of the nonfarm and town residential consumers are presently using LP gas, and the other half reported no intention of doing so. The major purpose for which LP gas is used is cooking. About two-thirds of the total indicated increase in residential load will be in active competition with LP gas. Almost without exception none of the farm respondents who were using LP gas indicated to the appraiser that they planned to convert their gas appliances to electric appliances in the foreseeable future.

TABLE VII

STATUS OF LP GAS USE 123 FARM RESPONDENTS IN RANDOM SAMPLE SURVEY

Consumers' Position With Respect to Use of Gas	Number in Survey	Percent of Total
Not using and not planning to use	77	63
Presently using	46	37
Used For:		
Cooking	39	
House Heating	8	
Water Heating	7	
Chick Brooding	3	
Refrigeration	2	
Total	123	100

The manager estimates that the ultimate number of farm consumers will exceed the presently connected number by only 215. This indicates that the system is approaching complete area coverage. Table III lends support to this contention; the majority of the farm respondents in the sample were connected in 1949, 1950, and 1951, and since then they have been added at a decreasing rate. In addition, the field survey indicated that most of the area is being served. As area coverage is approached, the dilution effect upon average kwh consumption diminishes because fewer new consumers, most of whom are usually small users initially, are added to the lines.

Schedules from 25 farm respondents located within the Sand Hills area were given special study to determine if the consumption of electricity in this sector differed appreciably from that in the rest of the system area.

TABLE VIII

ITEMS REFLECTING CONSUMPTION PATTERN SAND HILLS AREA COMPARED WITH REST OF SYSTEM AREA

Item of Comparison	Sand Hills Area (25 Respondents)	Remainder of System Area (98 Respondents)
Indicated Present Average KWH/mo.	322	294
Indicated Average KWH/mo. to be Added in 3 Years	120	89
Indicated Total Future Average KWH/mo.	442	383
Attained Average KWH/mo. Based on Respondent's Billing Record - 1952	317	287
Percent of Indicated Present Average KWH/mo. Attained as Revealed by Respondent's Billing Record - 1952	98	98

In Table VIII it is revealed that present consumption of electricity (indicated and actual) by the Sand Hills area respondents exceeds comparable consumption figures for respondents in the rest of the area by 10 percent. Based on their 1952 billing records respondents in both areas attained about 98 percent of their indicated present consumption.

Though the appraiser noted considerable evidence of farm abandonment in the Sand Hills area, all of the respondents stated they planned to remain on their farm indefinitely. Most of the farm abandonment had occurred during the extremely dry years of the middle 1930's. Since then, most of the land then abandoned has been merged with adjacent farms. The average size of the farms of respondents in the Sand Hills area is 1,010 acres, as compared to about 625 acres for the entire system area. Livestock, mostly cattle and calves, and hay are the main source of agricultural income in this area; very little grain is raised. Larger tracts of land are required to farm an economic unit in this area, which is best suited for grazing and hay crops, and it appears that such has been accomplished since the great drought of the middle 1930's.

From Table IX, trends in the area relative to the State indicate the service area to be generally holding its own. Populationwise, the area is increasing slightly in importance relative to the State. The percent of decrease in number of farms in the service area has been a little greater than for the whole State since 1935. The trend in valuations of land and buildings is favorable to the area but the absolute values are below the State average. The trend in average farm income is unfavorable to the area but is above the State average in absolute terms. Power costs have risen, both absolutely and relatively, from 1942-1951, but has fallen slightly since 1951 when the system began securing a portion of their power from the REA-financed federated cooperative at Minot (North Dakota 42 Ward). The average kwh consumption for farms in the service area is considerably above each of the neighboring cooperatives, one of which has been energized about as long as this system.

TABLE IX

TRENDS RELATED TO THE RATE OF INCREASE IN USE OF ELECTRIC POWER

Item and Relationship	Trend							
Population	1920		1930		1940		1950	
Service Area	52,290		56,409		52,631		52,591	
State of North Dakota	646,872		680,845		641,935		619,636	
Ratio Area to State	.081		.083		.082		.085	
Number of Farms	1910	1920	1925	1930	1935	1940	1945	1950
Service Area	6,349	5,858	5,786	5,888	6,173	5,457	4,954	4,618
State of North Dakota	74,360	77,690	75,970	77,975	84,606	73,962	69,520	65,401
Ratio Area to State	.085	.075	.076	.076	.073	.074	.071	.071
Average Income From All Farm Products Sold					1939	1944	1949	
Service Area					1,547	4,905	6,274	
State of North Dakota					1,357	5,248	6,129	
Ratio Area to State					1.14	.93	1.02	
Average Value of Land and Buildings					1940	1945	1950	
Service Area					5,068	8,850	15,615	
State of North Dakota					6,628	10,189	18,014	
Ratio of Area to State					.76	.87	.87	

Cost of Purchased Power Per KWH	1942	1944	1946	1948	1949	1950	1951	1952
North Dakota 17 McHenry								
Source-Bur.of Reclamation	—	—	—	—	—	.59¢	.55¢	.54¢
Source-Private Power Co.	1.15¢	1.14¢	1.10¢	1.19¢	1.36¢	1.65¢	1.67¢	1.66¢
Source-REA Federated Co-op	—	—	—	—	—	—	—	1.25¢
Weighted Average	1.15¢	1.14¢	1.10¢	1.19¢	1.36¢	1.61¢	1.63¢	1.50¢
All Co-ops in North Dakota	1.18¢	1.13¢	1.11¢	1.32¢	1.38¢	1.46¢	1.39¢	1.29¢
Ratio Area to State	.97	1.01	.99	.90	.98	1.10	1.17	1.16

Average Monthly KWH Consumption Per Farm Consumer	1941	1942	1944	1946	1948	1949	1950	1951	1952
North Dakota 17 McHenry	64	91	148	162	221	226	209	233	259
Neighboring Co-ops									
Co-op A	84	100	136	138	224	210	211	196	226
Co-op B	—	—	—	—	144	168	172	194	220
Co-op C	—	—	—	—	—	113	133	157	193
Co-op D	—	—	—	—	—	116	121	155	175
Weighted Average-4 Co-ops	84	100	136	138	205	168	170	182	213
Ratio N.D.17 to Wtd.Ave. 4 Co-ops	.76	.91	1.09	1.17	1.08	1.34	1.23	1.28	1.22

Considering the firmly established use and probable continued use of LP gas in the service area, the maturity of the system, and the fact that the area characteristics show few advantages over similar State characteristics, the attainment of indicated consumption within the 3-year period appears to be unlikely at this time. On the basis of these and related factors, it is estimated that within 3 years' time, a 50 percent increase for water heaters, ranges, and clothes driers will be realized. About 95 percent of the increase attributed to refrigerators, 80 percent to home freezers, 55 percent to pressure systems, and 90 percent to television receivers are also expected to be realized. It is also estimated that 90 percent of the indicated increase due to productive and other uses will be realized. Kilowatt-hour increases at these rates are shown in Table VI.